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# Are wives and daughters disadvantaged in polygynous households? A case study of the Arsi Oromo of Ethiopia

Caroline Ugglä<sup>a,b,\*</sup>, Eshetu Gurmu<sup>c</sup>, Mhairi A. Gibson<sup>b</sup>

<sup>a</sup> Stockholm University Demography Unit (SUDA), Department of Sociology, Stockholm University, SE-106 91 Stockholm, Sweden

<sup>b</sup> Department of Archaeology and Anthropology, University of Bristol, 43 Woodland Road, Bristol BS8 1UU, United Kingdom

<sup>c</sup> Center for Population Studies and Institute of Development and Policy Research, Addis Ababa University, Main Campus, 6 Kilo, Addis Ababa, Ethiopia

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## ABSTRACT

Whether polygyny is harmful for women and their children is a long-standing question in anthropology. Few studies, however, have explored whether the effect of polygyny varies for women of different wife order, and whether there are different outcomes for their sons and daughters. Because males have higher reproductive variance, especially when they are allowed to take multiple wives, parents may have higher fitness returns from investing in sons over daughters in polygynous households. Moreover, previous studies have found that first wives and their children are advantaged over monogamous and second order wives (who marry into unions later). Here we test the predictions that children of first wives will have an advantage over children to monogamous or second wives, and that sex-biased investment will be strongest among first wives. Using data from the Arsi Oromo of Ethiopia ( $n \sim 6200$  children) we test whether associations with mother's wife order extend beyond childhood into adulthood by examining simultaneously child survival, education and age at marriage. We find that polygynous first wives have no child survival disadvantage, first wives' sons benefit in terms of longer education and daughters have an earlier age at marriage than daughters of monogamous women. Second wives have lower child survival than monogamous women, but surviving children experience advantages in later life outcomes, particularly marriage. These findings challenge the view that polygynous women are always doing the 'best of a bad job'. Rather, our results suggest that via their surviving sons and daughters there may be long-term benefits for some polygynous women.

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## 1. Introduction

Polygyny, the marriage practice where men are allowed to marry multiple wives, exists in circa 80% of human societies (Murdock & White, 1969) and its consequences for women and children has been subject to much debate (Borgerhoff Mulder, 1992; Fortunato, 2015; Gibson & Mace, 2007; Hadley, 2005; Henrich, Boyd, & Richerson, 2012; Lawson et al., 2015; Sellen, 1999; Strassmann, 1997; Strassmann & Gillespie, 2002; Winking, Stieglitz, Kurten, Kaplan, & Gurven, 2013). While the benefits of polygyny to men include both a larger family size and labour participation from multiple wives (Luttbeg, Borgerhoff Mulder, & Mangel, 2000), the benefits to women of sharing a husband with other wives are less evident. Evolutionary anthropologists have argued that women should favour polygyny when the share of resources a woman receives from a polygynous husband is equal to or larger than the resources she would get from being monogamous (Borgerhoff Mulder, 1992; Fortunato, 2015; Gibson & Mace,

2007). This is known as the 'polygyny threshold model' (Orians, 1969; Verner & Willson, 1966) and it predicts that if women, or parents on their behalf, are free to choose men, there should be no negative net effect of polygyny.

The empirical evidence of child outcomes associated with polygyny is mixed and has often been operationalized as various measures of physical child health or survival (see Lawson & Ugglä, 2014 for review). Negative associations with child health and survival have been found in several small-scale societies (Hadley, 2005; Omariba & Boyle, 2007; Sellen, 1999; Strassmann, 1997) but few studies have considered how factors at the individual or household level may shift the costs and benefits of polygyny. This is important because results based on an overall population may obscure the true consequences of alternative marital strategies for individual women. For example, among the Kenyan Kipsigis negative associations with polygyny were found only in the poorest households (Borgerhoff Mulder, 1997) and in a study from Tanzania, Lawson et al. (2015) report that child health is only negatively associated with polygyny in female-headed households. But there may also be heterogeneity within households. Previous evidence from the current population, the Arsi Oromo of Ethiopia, suggests that wife order influences how polygynous women and their children fare;

\* Corresponding author at: Stockholm University Demography Unit (SUDA), Department of Sociology, Stockholm University, SE-106 91 Stockholm, Sweden.

E-mail address: [caroline.uggla@sociology.su.se](mailto:caroline.uggla@sociology.su.se) (C. Ugglä).

polygynous second order wives (who marry into unions later) have more similar child health outcomes to monogamous women than to polygynous first wives (Gibson & Mace, 2007). Gibson and Mace (2007) also found that first wives marry younger and have better health compared to second wives. It has often been assumed that when second wives do poorly, their marital strategy is the 'best of a bad job' (Krebs & Davies, 1993), as the alternative strategy would be to marry a man with fewer resources monogamously, or not marry at all. In this study, we examine this view more closely by considering how polygyny is tied to both short and long-term outcomes of sons and daughters and whether such outcomes vary by mother's wife order.

### 1.1. Sex-specific effects of polygyny

A notable absence in the polygyny literature is that few studies have tested whether a woman's wife order produces different costs for her sons and her daughters. This is problematic because an overall effect of polygyny, or absence thereof, might obscure a cost to a particular group of children (e.g. daughters) that might be outweighed by benefits to another group (e.g. sons). Evolutionary models of parental investment stipulate that parents have limited resources and will allocate those resources in a manner that maximizes fitness (Trivers, 1972). One way in which sex-specific effects of polygyny might arise is if dilution of paternal investment in polygynous households leads to greater quality–quantity trade-offs, making parents prioritize the children who can bring the highest returns on investment. However, it is not sufficient to make predictions based on presence of polygyny alone, because wife order can also affect the degree of resource dilution children are affected by. Assuming that first wives, who generally have better health and higher status, are more likely to have sons who become polygynous, first wives might resolve parental investment trade-offs in favour of sons. This is because sons have higher variance in reproductive success than daughters, especially when they are allowed to take multiple wives. But because it is costly to pay brideprice for multiple wives, not all sons can become polygynous. The prediction of a son-bias among polygynous first wives is in line with the Trivers–Willard hypothesis which stipulates that parents with more resources should favour sons, whereas those with fewer resources should favour daughters in order to maximize reproductive success (Trivers & Willard, 1973). Alternatively, sons may be advantaged in all polygynous households, regardless of their mother's wife order. This might be the case if fathers pass on important traits or shareable resources to their same-sex offspring (e.g. social status or physical attractiveness) that increase their marriage chances regardless of their mother's wife order.

Among our study population, the Arsi Oromo, the resources fathers pass on to their sons are primarily dilutable (cattle and material wealth), hence it is more likely that sons of polygynous first wives will be advantaged compared to sons of monogamous or second wives. Moreover, it is possible that sex-biased investment in polygynous households could arise due to differences in local resource enhancement. Sons who can work in skills-based jobs are more likely to bring benefits from education and have higher income-generating potential than daughters who are less likely to receive an education due to norms of early marriage. With this background, we make the two following predictions:

#### 1. Wife order

If first wives enjoy greater benefits in polygynous marriages than second order wives, having a mother who is a first wife should be associated with higher parental investment, as compared to having a mother who is monogamous or is a second order wife or higher.

#### 2. Wife order and child's sex

If first wives enjoy greater benefits in polygynous marriages than second order wives, and their sons have higher fitness returns because they can take multiple wives, sex-biased investment favouring sons should be greater among first wives, than among monogamous or second order wives.

### 1.2. Aims of the paper

We address the question of whether wife order predicts offspring outcomes and whether there are sex-specific effects of polygyny (i.e. a stronger son-bias in polygynous than in monogamous households) and how such effects vary by wife order. We consider outcomes both early in life (survival to age 5) and two important longer-term outcomes: educational attainment and age at first marriage. Evolutionary anthropologists have been interested in child survival and health as proxies for reproductive success of polygynous versus monogamous women, but few have followed children into adulthood or to marriage. In many traditional and/or small-scale societies marriage is synonymous with reproduction because childbearing rarely occurs out of wedlock. While child health can be a measure of interest in and of itself, we argue that additional measures of how offspring fare in early adulthood are necessary to better understand the consequences of polygyny that natural selection acts on.

This study has at least three key strengths: i) we have a highly detailed, yet broad dataset of 6284 mother–child pairs which includes data on mother's wife order, ii) we explicitly compare the effect of wife order for sons and daughters separately, and iii) we move beyond early life outcomes and examine how polygyny is associated with children's education and marriage opportunities that are linked to reproductive fitness.

## 2. Methods

### 2.1. Study population

The Arsi Oromo are agropastoralists who rely on cattle-rearing as well as maize, wheat, and sorghum cultivation for their livelihood in the rural low-lying areas of the Arsi Administrative Zone, in the Oromiya Region, Ethiopia. Mean parity (live births) is 6.2 children (std dev 2.83). Mortality rates remain high but have been declining in recent decades (Gibson & Gurmu, 2011). Inheritance is patrilineal and husband and wife generally reside with the husband's patrilineage at marriage (patrilocal residence). Each cowife has her own residential compound, which are well-distributed across the farming landscape. The Arsi Oromo are conservative with regards to marriage; divorce or separation is uncommon, making this an ideal population to test wife order effects. In populations where marriages are more unstable, a woman's wife order might change a number of times during her lifetime. Moreover the Arsi Oromo have a strong cultural preference for sons, expressed for example in terms of educational investment (Gibson & Sear, 2010). While education is becoming more common, it is still rare, and the largest intergenerational transfer of resources from parents to offspring occurs upon a child's marriage. A majority of daughters receive a small dowry composed of household materials whereas sons are endowed with land holdings and bridewealth payments (brideprice), which are transferred to the bride's family. Bridewealth payments often take many years to accumulate, resulting in late ages at marriage for males (Gibson & Gurmu, 2011). High status marriage partners (due to wealth or family status) attract both higher bridewealth and have higher reproductive success (Gibson & Mace, 2007). In recent years the Arsi Oromo have been subject to government land redistribution reforms, which means that wealth differences have decreased and are comparatively small.

### 2.2. Data

Data were collected in 2009 on all 1226 ever-married women (mean age 39.0 years, std. dev. 13.30) resident in five neighbouring villages in Hitosa and Dodota weredas in the Arsi zone, Oromiya region. Household surveys comprising data on demographic and social factors and complete birth histories were taken. The mother was asked about each child's survival until age 5, level of education and marital status. The

women in our sample are all ever-married women; some are post-reproductive while some are still in their childbearing years. Questions were posed about age at first marriage, the number of other wives in the household at the time of her first marriage, her current wife order and the total number of wives in her marriage (i.e. whether she was currently monogamous (69.7%), a first wife (9.4%) or a second wife or higher (21.0%)). There was a high consistency between the two measures wife order at marriage and current wife order, and the latter was used in the analyses. Of the women who entered into a marriage with no other wives, 11% subsequently became first wives when their husband took an additional wife. We do not have information on when any subsequent wives joined the union and cannot adjust for the time span between marrying and becoming a first wife. However, because it is time consuming to accumulate the brideprice for a second wife, it is not uncommon that the period between marrying for the first and second time is around ten years. Children's education was coded as a binary variable, where 'any education' includes individuals who had received at least one year of schooling. Because schooling might vary from shorter periods to several years, we also ran a second set of models with education as a continuous outcome among those that had at least one year of schooling. Other variables we adjusted for include demographic variables that are likely to influence investment such as child's birth order, child's year of birth, mother's parity and religion (Muslim/non-Muslim). Wealth measures that we have access to such as cattle or land size are unreliable in this population but we use mother's education as a proxy for wealth. Maternal age was highly correlated with parity and could not be included in the models due to collinearity.

### 3. Methods

We ran multilevel logistic regressions for survival and probability of receiving any education, and multilevel linear regressions for age at marriage and the number of years of education among children with some education. Multilevel modeling can be used to control for non-independence of observations, as here when children (level 1) are clustered within mothers (level 2) (Snijder & Bosker, 2011). For each outcome and sex we ran a set of models with wife order only, and full models with all covariates. All analysis was conducted in Stata 14.

### 4. Results

We compare some basic demographic outcomes for the women by their current wife order, adjusting for age (Table 1). Women who become polygynous first wives marry at 15.7 years on average, compared to 16.2 years to monogamous (though this difference is not statistically significant) (Table 1). First wives have 6.6 births on average, whereas monogamous or second order wives or higher have 6.2 and 5.9 births on average, respectively. The number of children who survive to age 5 ranges between approximately 5.3 (first wives) and 4.7 (second order wives) (Table 1). About 25% of monogamous women have some education, and corresponding figures for first and second wives are 24 and 21% (Table 1).

Table 2 shows the raw data for child outcomes by sex and mother's current wife order. 80% of girls to monogamous women and 78% of boys survive until their fifth birthday. The corresponding figures for first wives are 73 and 72%, with second wives at intermediate values (Table 2). Monogamous women's daughters marry at 18.3 years compared to 17.3 years on average for daughters of first and 17.6 years for

second wives. Sons of first wives marry marginally younger than sons of monogamous women, but this difference is not significant (Table 2). First wives have a higher probability of getting some education for their children (59% for daughters and 71% of sons) compared to monogamous or second order wives (44–45% of daughters and 50–56% of sons) (Table 3). Sons of first wives who receive some education have on average 6.6 years of schooling, whereas sons of monogamous or second wives have approximately 5.3 years. Girls have a shorter duration of education, but differences with mother's wife order are not statistically significant (Table 3).

We ran multilevel logistic regression models for survival to age 5 to test whether there is a relationship between wife order and child survival and whether this differs by sex. Results show that there are no significant differences in child survival between monogamous women and first wives, but second order wives or higher have 23–24% lower odds of survival for sons and daughters than monogamous women (Table 4). With regard to education, results show no significant effects of wife order on the odds of attending school for either daughters or sons. However, sons of first wives who are sent to school obtain more years of completed education (Table 4).

Finally, linear multilevel regression models suggest that polygamously married women (first wives and second order wives or higher) have daughters who marry younger compared to monogamous women (Table 4). The magnitude of the effect is large; daughters of polygynously married women marry approximately one year earlier than daughters of monogamous women. These effects become apparent for daughters of second order wives in the full model (but are not significant in the model without confounders), implying that only when differences in mother's parity, education and child's birth order are held constant does wife order predict daughter's age at marriage. There is no evidence that a woman's wife order is associated with her sons' age at marriage (Table 4).

### 5. Discussion

These findings lend support to the idea that polygyny as a marital strategy is not always associated with harmful outcomes for children. On the contrary, the results demonstrate an advantage of polygynous first wives in terms of a longer period of education for sons and an earlier age at marriage for daughters. For daughters' age at marriage, the benefits of polygyny are present regardless of whether the mother is a first or second wife. Education and age at marriage are important outcomes because they are closely associated with better marriage prospects e.g. higher status marriage partners in this population.

Contrary to our prediction, we find no support for a stronger son-bias among children to polygynous first wives than monogamous women. In the null model, polygynous first wives appeared to have sons with higher odds of education, but this effect applied to their daughters as well, and disappeared in the full model when we controlled for maternal education. Parental investment in education has been linked with a shift towards a skill-based economy (Kaplan & Lancaster, 2003; Mace, 2008). This is likely because parents can only start to expect payoffs from education when job opportunities that require schooling are more likely to materialize. While education is free in Ethiopia, parents incur loss of household labour participation. Education beyond primary level is particularly expensive as secondary schools are not available locally, requiring parents to cover the extra costs of transport and accommodation to/in a neighbouring market town. In

**Table 1**

Women's (n = 1015) characteristics by wife order with 95% confidence intervals, controlling for woman's year of birth.

	Age at marriage (in years)	Number of live births	Number of surviving children (to age 5)	Any education
Monogamous	16.17 (16.03, 16.30)	6.24 (6.09, 6.40)	5.14 (4.99, 5.28)	0.25 (0.22, 0.28)
1st wife	15.70 (15.33, 16.07)	6.59 (6.16, 7.02)	5.28 (4.88, 5.68)	0.24 (0.14, 0.34)
2nd wife or >	16.57 (16.33, 16.81)	5.89 (5.61, 6.17)	4.67 (4.41, 4.93)	0.21 (0.15, 0.26)



**Table 2**  
Mean proportion of children who survive to age 5, and mean age at marriage with 95% confidence intervals, by mother's wife order.

	Survival to 5 years mean (95%CI)			Age at marriage mean (95%CI)		
	Girls (N = 3139)	Boys (N = 3145)	Total (N = 6284)	Girls (N = 624)	Boys (N = 389)	Total (N = 1013)
Monogamous	0.80 (0.79, 0.82)	0.78 (0.76, 0.80)	0.79 (0.78, 0.80)	18.35 (18.00, 18.71)	22.10 (21.54, 22.66)	19.81 (19.47, 20.16)
1st wife	0.73 (0.69, 0.78)	0.72 (0.68, 0.76)	0.72 (0.70, 0.76)	17.29 (16.75, 17.82)	21.19 (20.20, 22.18)	18.78 (18.22, 19.33)
2nd wife or >	0.76 (0.73, 0.79)	0.74 (0.70, 0.77)	0.75 (0.73, 0.77)	17.60 (16.95, 18.26)	23.38 (21.21, 24.54)	19.75 (19.04, 20.45)

line with previous studies (Gibson & Lawson, 2011; Gibson & Sear, 2010), we identify a strong birth order bias in probability of education; older siblings have higher odds of education regardless of sex. For duration of sons' education, we find evidence of an association with birth order, which might be suggestive of a stronger bias in length of education for sons than for daughters. These results imply that future studies on child outcomes and polygyny should take into account wife order, sex and birth order simultaneously in order to capture the individualized costs and benefits mothers have.

Our data show that girls receive less education, which may reflect the higher risks and lower returns of female education. By sending girls to school, families may miss out on their domestic labour within the household; and there is a greater risk of premarital sex and abduction, which can negatively affect a girl's marriage prospects. For both genders there are few skill-based jobs (subsistence agriculture is the most common) (Gibson & Gurmu, 2011), however educated males have the potential to gain higher status marriages (pay higher bridewealth payments), and have more surviving offspring than males without education (Gibson & Gurmu, 2014). Thus, it is possible that the benefits that parents attain from investing in their sons' education come mostly through marriage prospects.

For daughters the benefits of polygyny come in terms of an earlier age at marriage. For Arsi Oromo women, marriage remains the main path to acquire social status and economic security. While in some populations an early age at marriage might be seen as disadvantageous, previous evidence suggests that Arsi Oromo women who are in better health marry at younger ages (Gibson & Mace, 2007). Nevertheless, age at marriage can be interpreted in different ways because parents who invest in daughters' education could be trading a later age at marriage for a better marriage partner. In line with this, it has been found that educational attainment increases female bridewealth among the Arsi Oromo (Gibson & Gurmu, 2014). Sons' age at marriage, however, is mainly constrained by parental wealth as bridewealth is a strain on parental resources. That sons of first wives who get some education, stay in school for longer than sons of monogamous or second order wives (even though first wives are not more likely to have an education themselves), implies that benefits of first wives are due to some property other than intergenerational transmission of education.

Polygyny is a marriage system closely linked to resource inequality and conflict between men over women, and between women over resources for their own offspring. Marrying a daughter to a married man under these conditions may be the best of the locally available options for some parents. This is sometimes referred to as doing the 'best of a bad job' (Krebs & Davies, 1993). Our results on children's education

and marriage show that patterns might be a little more complex. While we find evidence that second wives do have costs initially in terms of lower child survival, if their children survive to age five, they also have benefits over monogamous women in that their daughters marry younger. A parallel can be drawn to Josephson's findings from the Mormons in Utah; although polygynous second order wives and higher had lower fertility than monogamous women and first wives, this reduction was offset by higher fertility of the children of all polygynous women (Josephson, 2002). It is not entirely clear why children of second wives have advantages in later outcomes, it may simply be that having survived the risky period of early childhood they are also more likely to do better in later life outcomes (i.e. phenotypically stronger individuals have been selected).

It is important to consider the factors that underpin any advantages of polygynous women. In the null model, first wives had lower child survival probabilities than monogamous women but these differences disappeared when important covariates such parity and maternal education were added, implying that unmeasured phenotypic differences between first wives and monogamous women impact child survival. While it has been suggested that polygyny is associated with negative impacts such as social stress and depression, there is no convincing evidence that this is the case (Bove & Vaggia, 2009; Patil & Hadley, 2008). On the contrary, there are accounts that show that cowives can be an important source of social support and offer cooperative benefits that monogamous women do not have (Scelza, 2015). Both subsistence tasks and childcare can be shared between cowives and benefits of scale that come from dividing such burdens possibly reduces stress of polygynous women.

Wife order is also likely to impact the social support and status of polygynous women. Among the Arsi Oromo, the wife who bears the first son (usually the first wife) receives greater social status from the community and within the household. Other studies have identified that senior cowives can get the lion's share of resources and are given authority over younger cowives (Jankowiak, Sudakov, & Wilreker, 2005). It is also possible that social selection is in part responsible for the more advantageous child outcomes of polygynous women. This would be the case if women who end up in polygynous unions possess some characteristic, e.g. good health, beauty, or higher relational wealth, that lead them to both be married polygynously and to have children who are better-off. To address this question with detailed longitudinal data should be a priority for future research.

Lastly, it should not be assumed that polygyny will have the same effect on all children or in all populations. This is an important insight for policy makers and development practitioners who aim to design and

**Table 3**  
Mean proportion of children who receive any education and mean years of schooling among ever educated children, with 95% confidence intervals, by mother's wife order.

	Any education mean (95%CI)			Years of education mean (95% CIs)		
	Girls (N = 2480)	Boys (N = 2405)	Total (N = 4885)	Girls (N = 1022)	Boys (N = 1225)	Total (N = 2247)
Monogamous	0.45 (0.43, 0.48)	0.50 (0.48, 0.52)	0.49 (0.48, 0.51)	4.35 (4.15, 4.55)	5.35 (5.13, 5.56)	4.89 (4.74, 5.04)
1st wife	0.59 (0.53, 0.64)	0.71 (0.66, 0.76)	0.63 (0.60, 0.68)	4.56 (4.14, 5.00)	6.57 (6.09, 7.05)	5.67 (5.33, 6.01)
2nd wife or >	0.44 (0.40, 0.48)	0.56 (0.52, 0.60)	0.50 (0.47, 0.53)	4.20 (3.83, 4.58)	5.29 (4.90, 5.68)	4.80 (4.52, 5.08)

**Table 4**  
Multilevel logistic regression (survival and any education) and multilevel linear regression (age at first marriage, and years of education) by mother's wife order. Null model: only with wife order in model, full model: all covariates. OR - odds ratio, ICC - intraclass correlation coefficient. Significance level indicated by \* $p < 0.05$ , \*\* $p < 0.01$ , and \*\*\* $p < 0.001$ . Survival to age 5 is restricted to children in mother's birth history born at least 5 years prior to the study, any education to children age 7 or older at the time of the study, age at marriage individuals age 18 or older at the time of the study, and years of education individuals age 24 or older at the time of the study.

	Survival to age 5				Any education				Age at marriage				Years of education			
	Girls		Boys		Girls		Boys		Girls		Boys		Girls		Boys	
	OR (95% CIs)	Ref	OR (95% CIs)	Ref	OR (95% CIs)	Ref	OR (95% CIs)	Ref	B (95% CIs)	Ref	B (95% CIs)	Ref	B (95% CIs)	Ref	B (95% CIs)	Ref
Null model																
Monogamous	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
1st wife	0.61 (0.44, 0.84)**		0.79 (0.52, 0.93)*		2.13 (1.40, 3.22)***		2.79 (1.77, 4.39)***		-0.84 (-1.67, -0.01)*		-0.98 (-2.26, 0.30)		0.28 (-0.24, 0.80)		1.38 (0.80, 1.97)***	
2nd wife or >	0.75 (0.58, 0.96)*		0.77 (0.60, 0.98)*		1.00 (0.74, 1.37)		1.25 (0.90, 1.77)		-0.52 (-1.34, 0.29)		0.96 (-0.36, 2.28)		-0.12 (-0.58, 0.33)		0.01 (-0.50, 0.51)	
Full model																
Monogamous	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
1st wife	0.93 (0.69, 1.28)		0.87 (0.65, 1.17)		1.30 (0.85, 1.98)		1.59 (0.92, 2.75)		-1.19 (-2.05, -0.34)**		-1.21 (-2.52, 0.09)		0.27 (-0.26, 0.80)		1.38 (0.79, 1.96)***	
2nd wife or >	0.76 (0.58, 0.98)*		0.77 (0.61, 0.98)*		1.07 (0.78, 1.47)		1.16 (0.77, 1.77)		-0.91 (-1.76, -0.06)*		0.88 (-0.46, 2.23)		0.07 (-0.39, 0.54)		0.14 (-0.36, 0.65)	
Child's birth order	1.19 (1.14, 1.24)***		1.14 (1.10, 1.18)***		0.78 (0.74, 0.82)***		0.53 (0.49, 0.58)***		0.01 (-0.10, 0.12)		-0.18 (-0.34, -0.01)*		-0.03 (-0.11, 0.03)		-0.27 (-0.33, -0.19)***	
Mother's parity	0.76 (0.73, 0.80)***		0.80 (0.77, 0.84)***		1.55 (1.46, 1.66)***		2.45 (2.20, 2.73)***		-0.08 (-0.22, 0.05)		0.11 (-0.09, 0.32)		0.19 (0.10, 0.28)***		0.37 (0.27, 0.46)	
Maternal education	1.51 (1.13, 2.02)**		1.29 (0.99, 1.70)		1.02 (0.75, 1.40)		0.98 (0.66, 1.49)		0.23 (-0.87, 1.32)		1.28 (-0.76, 3.32)		-0.21 (-0.69, 0.25)		-0.69 (-1.22, -0.15)**	
Religion (Muslim)	1.26 (0.94, 1.69)		1.05 (0.82, 1.36)		1.15 (0.82, 1.60)		1.27 (0.83, 1.94)		-1.14 (-1.95, -0.33)**		-0.99 (-2.44, 0.26)		0.45 (-0.02, 0.93)		0.44 (-0.09, 0.96)	
ICC (std err)	0.11 (0.03)		0.08 (0.03)		0.29 (0.04)		0.46 (0.04)		0.32 (0.05)		0.29 (0.06)		0.16 (0.04)		0.24 (0.03)	
	n = 3139		n = 3145		n = 2480		n = 2405		n = 624		n = 389		N = 1022		n = 1225	

implement efficient public health interventions in areas where polygyny is practiced. Our results have shown that it is crucial to consider outcomes that are relevant for each sex in order to understand parental payoffs accurately. We also found patterned differences with birth order and family size. That these two variables went in opposing directions in, for example, the child survival model, implies that the relationship between a child's birth order and survival might vary depending on family size. Furthermore, the parental payoffs might be influenced both by the mother's wife order and the costs and benefits associated with particular health behaviours that impact survival chances. For example, Ugglu and Mace (2016) found that children of polygynously married mothers were less likely to benefit from preventative health behaviours (e.g. immunization and bed net use) but there was no difference between monogamous and polygynous women in whether children received curative health behaviours (e.g. treatment for fever). Curative health measures might be less costly for women to administer on their own, whereas more costly long-term health-seeking might be subject to dilution between co-wives.

We have shown that Arsi Oromo polygynous first wives appear to have a number of advantages over monogamous women; most notably there are benefits of polygyny through the improved marriage opportunities of their children. We find no evidence of an overall son-bias in polygynous households. Rather, we identify that through outcomes that capture the offspring's marital opportunities, there may be benefits of polygyny for both sexes: duration of education for sons and early age at marriage for daughters. Our results add to the evidence that polygyny should not universally be considered a harmful cultural practice (Lawson et al., 2015) and do therefore not support the idea that socially imposed monogamy is driven by cultural group selection (Henrich, Boyd & Richerson, 2012). To measure outcomes that are indicators of the longer-term impact of polygyny is important because it enables a better understanding of mechanisms underpinning polygyny and ultimately what sustains the marriage practice.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.evolhumbehav.2017.11.003>.

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